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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,358	11/24/2004	Hacene Lahreche	15675P556	2705

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/516,358	LAHRECHE ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-11 and 13-23* is/are pending in the application.

4a) Of the above claim(s) *20 and 21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 3-11, 13-19 and 22-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/ are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/30/2007 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 18-19, and 22-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Beaumont et al (US 6,325,850).

In a method of epitaxial lateral overgrowth of GaN, note entire reference, Beaumont et al teaches the deposition of a layer of GaN; deposition a dielectric layer, which is etched; deposition of GaN in the openings and lateral growth until the patterns coalesce (col 3, ln 1-45 and Example 1). Beaumont et al also teaches these surfaces resulting from the coalescence of islands exhibit superior crystal quality to the layers grown heteroepitaxially on sapphire (col 4, ln 15-45) and lower defect density (col 9, ln 1-40). Beaumont et al also teaches the epitaxial layer

has a thickness between 1 and 1000 micrometers and it is self-supported after the substrate has been removed.

Referring to claim 18-19, are product-by-process claims which depend from the process of claim 1, which requires separation by ion implantation. The patentability determination of a product-by-process claim is based on the patentability of the product and does not depend on its method of production (MPEP 2113). Beaumont et al discloses GaN film and teaches all of the instantly claimed product limitations, thus meets claims 18-19. The method of separation does not impart any product limitations to the GaN film of claims 18-19.

Referring to claims 22-23, Beaumont et al teaches a laser diode (col 2, ln 1-5).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 3-11-13-19, and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogawa et al (US 6,723,165) in view of Beaumont et al (US 6,325,850) and further in view Aspar et al (WO 01/93325 A1), where US 2003/0077885 A1 is used as an accurate translation, and in view of Yoshida et al (US 6,303,405).

In a method of forming a self-support GaN film, note entire reference, Ogawa et al teaches depositing a layer of GaN **65** on a sapphire substrate **11** by HVPE; implanting H^+ protons into the GaN layer **65** at an energy of 180 keV and a dose of $5.0x10^{16}$ atoms/cm^2 to form a damaged implanted region **66**; further depositing a GaN layer **67** by HVPE on the GaN layer **65**; and separating the sapphire substrate and the GaN layers to obtain a GaN substrate **67a** using a laser beam (col 19, ln 1-67 and Figs 9A-9F).

Ogawa et al does not teach the deposition of GaN comprises at least one step of epitaxial lateral overgrowth.

In a method of epitaxial lateral overgrowth of GaN, note entire reference, Beaumont et al teaches the deposition of a layer of GaN; deposition a dielectric layer, which is etched; deposition of GaN in the openings and lateral growth until the patterns coalesce (col 3, ln 1-45 and Example 1). Beaumont et al also teaches these surfaces resulting from the coalescence of islands exhibit superior crystal quality to the layers grown heteroepitaxially on sapphire (col 4, ln 15-45) and lower defect density (col 9, ln 1-40).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Ogawa et al by forming the GaN layer **67** using the lateral overgrowth

process of forming GaN, as taught by Beaumont et al, to produce a GaN with superior crystal properties and reduced defect density.

The combination of Ogawa et al and Beaumont et al does not teach a spontaneous sepation step at the weak area to obtain a self-supported film of GaN.

In a method of separating a film from a substrate, note entire reference, Aspar et al teaches implanting hydrogen at 210 keV at a dose of $6x10^{16}/cm^2$ into a GaN substrate and separation by a thermal means ('885 [0024]-[0028]; [0046] and [0055]). Aspar et al also teaches the application of heat treatment steps and/or stresses at the weakened zone ('885 [0043]) and separation may be carried out by different means which may be thermal means combined with mechanical means ('885 [0055]). Aspar et al also teaches hydrogen implantation creates cavities which are enlarged into cracks that allow for separation ('885 [0083]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Ogawa et al and Beaumont et al by a heat treatment as taught by Aspar et al by separating the film using thermal stresses.

The combination of Ogawa et al, Beaumont et al and Aspar et al teaches implanting with hydrogen ions to create cavities and cracks, and separation via thermal means. The combination of Ogawa et al, Beaumont et al and Aspar et al does not teach the thermal means is by cooling after epitaxial growth.

In a method of separating a film from a substrate, note entire reference, Yoshida et al teaches applying a stress to separate a substrate by suddenly decreasing the temperature after growth of a multi-layered structure instead of using a tool or separating a substrate by irradiating laser light onto a sapphire substrate (col 7, ln 1-30). Yoshida also teaches separation along cracks

and voids (col 6, ln 50-67), which clearly suggests that separation of a III-V nitride layer containing cracks and voids by suddenly decreasing temperature after growth was known in the art at the time of applicant's invention. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Ogawa et al, Beaumont et al and Aspar et al by separating the layers by suddenly decreasing temperature to impart a thermal stress, as taught by Yoshida et al, to separate the film during the cooling of the structure after deposition, which would simplify the separation process and suggested by Aspar et al which teaches separation by thermal means.

Referring to claim 3, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al vapor phase ELO ('850 col 4, ln 20-45).

Referring to claims 4 and 16, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches HVPE ('850 col 4, ln 20-45).

Referring to claim 5, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches deposition of GaN; deposition of a dielectric layer, which is etched; deposition of GaN; deposition in opening until the growth coalesces ('850 col 3, ln 1-35 and Example 1).

Referring to claim 6, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches deposition of SiN, deposition of GaN and annealing at 1080°C so that the continuous layer converts to a discontinuous layer formed of GaN and growing GaN thereon ('850 col 8, ln 20 to col 9, ln 40). The combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al does not teach a SiN thickness of 10-20 nm, however it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the

combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al by optimizing the thickness of SiN to obtain GaN islands of a desired shape and size for subsequent growth.

Referring to claim 7, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al does not teach when the implantation occurs, however it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al by implanting after total coalescent of the these islands because separating a complete film is taught by Ogawa et al.

Referring to claim 8, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches H^+.

Referring to claims 9-11, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches hydrogen ions at a concentration of $5x10^{16}$ cm^{-2} using 180 keV ('165 col 19, ln 15-30).

Referring to claim 13, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches implanting 1.12 μm into the GaN layer.

Referring to claims 14-15, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches sapphire substrate ('850 col 9, ln 40-65 and '165 col 19, ln 1-15).

Referring to claim 17, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches doping with Mg ('850 col 7, ln 1-67).

Referring to claims 18-19, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches a GaN film with a thickness of 1-1000 micrometers ('850 col 5, ln 1-10), overlapping ranges are held to be *prima facie* obvious (MPEP 2144.05).

Referring to claim 22-23, the combination of Ogawa et al, Beaumont et al, Aspar et al and Yoshida et al teaches laser diodes ('850 col 2, ln 1-10).

Response to Arguments

6. Applicant's arguments with respect to claims 1, 3-11-13-19, and 22-23 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 10/30/2007 have been fully considered but they are not persuasive.

Applicant's argument that Beaumont fails to teach all of the elements of the product claims is noted but not found persuasive. Applicant alleges that Beaumont fails to teach a spontaneous separation step, which is clearly a process step and not a product limitation. There are no product limitations of the film of GaN recited, which are not taught by Beaumont.

Applicant's argument that Ogawa does not teach separation "at" the weak area is noted but not found persuasive. Applicant alleges that Ogawa teaches separation "above" the weak area. This is not persuasive because "at" and "above" are still the same for the purposes of the claim because there is a region that is implanted that is separated from the region that is not implanted, thus separation does occur "at" the weaken area. Applicant is merely arguing semantics, which does not result in a patentable difference. Furthermore, Aspar et al which is also relied upon to teach separation by implantation teaches separation along microcracks formed by implantation, which clearly suggests separation "at" the weakened layer.

Applicant's argument that Beaumont teaches epitaxial layer overgrowth (ELO) on a sapphire substrate, not a GaN layer is noted but not found persuasive. Beaumont teaches forming a GaN layer **2** on the sapphire substrate, masking the GaN layer and performing ELO on the masked GaN layer (Fig 3, Abstract and col 5, ln 45-67). Beaumont teaches ELO deposition of GaN on a GaN layer, thus the combination with Ogawa which teaches GaN deposition on a GaN layer is proper.

Applicant's argument that concluding that using thermal means would mean cooling down is improper is noted but not found persuasive. Applicant alleges that thermal means could also mean increase temperature thus the conclusion of using a cooling temperature is improper. First, either cooling or heating would be suggested since both mechanisms are capable of imparting the necessary stress to separate the semiconductor film, thus the use of a cooling technique would have been obvious to one ordinary skill in the art. Second, the use of a cooling means would have been obvious in view of Yoshida et al, as discussed above. Aspar et al teaches implantation forms cavities and cracks, and separation by thermal means ([0035]-[0036] and [0055]). Yoshida et al teaches apply stresses by suddenly decreasing temperature because of voids and cracks in the semiconductor layer (col 6, ln 55 to col 7, ln 30). Therefore the combination would have been obvious to one of ordinary skill in the art because cooling to impart stress to separate a semiconductor layer containing voids and cracks is known in the art.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
January 5, 2008

/Robert Kunemund/

Robert Kunemund

Primary Examiner

TC 1700